What Kind of Future for Energy Efficiency?

The relevance of the historic rationales for energy-efficiency programs has changed: the basis for future programs will depend on electricity industry structure, environmental policies, and public perception of remaining barriers in energy service markets.

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Since the late 1970s, more and more electric utilities have been running demand-side management (DSM) programs. By 1994, utility DSM programs cut potential summer peak demand by seven percent and annual electricity use by two percent nationwide. Much has changed since utility DSM programs were first proposed. Looking to the future, these changes will affect (1) the amounts of energy and demand reductions that are cost-effective; (2) the types of DSM programs that utilities will operate in the late 1990s; and (3) decisions by state public utility commissions (PUCs) to have utilities use ratepayer funds to operate them.

This paper speculates on the future of ratepayer-funded DSM programs. We focus initially on the original rationales for utility energy efficiency programs.[1] We review six distinct rationales: (1) to defer construction of new, large, expensive, and polluting power plants; (2) to reduce dependence on foreign oil; (3) to compensate for distortions in electricity prices; (4) to acquire a least-cost resource; (5) to reduce the adverse environmental effects of electricity production and transmission; and (6) to compensate for the absence of government programs and standards intended to improve the efficiency of electricity use. Based on our review, we then describe current issues that will influence the future role of utilities in delivering energy efficiency.

I. The Six Original Rationales

A. To Defer Construction of Power Plants

An early rationale for utility DSM programs was the opportunity to defer construction of new power plants. These plants were expected to take up to a decade to build and to be large (often reaching 1000 MW in size), expensive, and polluting. Proponents of utility energy efficiency programs argued that such programs could defer the need to build some of these power plants. Because of the small unit size and short lead-time for DSM programs, they were expected to provide flexibility to utilities and to reduce their financial risks compared with the large, long-lead-time power plants they would defer.

This rationale is less relevant today. Typically, today's plans for new generating resources call for gas-fired combustion turbines to meet peaking demands and for gas-fired combined-cycle units to meet baseload demands. The average size of the planned gas and oil units is 79 MW. Their small unit size and short construction time add considerable flexibility to utility plans to expand generating capacity. In addition, nonutility capacity additions between 1994 and 1996 are almost equal in total capacity to planned utility additions. The ability to buy power from others adds flexibility to a utility's resource portfolio because the purchase contract is not necessarily tied to any particular construction schedule or plant lifetime.

In the '70s and '80s, DSM addressed the revenue loss associated with selling power whose costs exceeded revenues. This is less relevant today.

B. To Reduce Dependence on Foreign Oil

Electric utility use of oil to generate electricity increased steadily after World War II. Although utility oil use represented only ten percent of the nation's oil consumption during the 1970s, concerns about oil imports and prices were sufficiently great that many oil-using utilities converted their plants to burn other fuels. Utility DSM programs were seen as one way to help reduce utility oil use and U.S. dependence on oil imports.

This rationale is also less relevant today. Utility dependence on oil has declined substantially during the past 15 years. Electric utilities now account for less than three percent of national oil use. Thus, the national-security concern about oil imports is much less of a utility issue than it formerly was.

C. Compensate for Distortions in Electricity Prices

As a result of utility reliance on high-cost fossil fuels and the composition of the generation stock, in the late 1970s and early 1980s avoided costs were much higher than average prices. The resulting price signal to consumers encouraged over-consumption. Utilities found it in their interest to run aggressive load-management programs to address the revenue loss associated with selling power whose costs far exceeded revenues.

This rationale, too, is less relevant today. During subsequent years, load growth turned out to be slower than expected, utilities built more capacity than needed, natural gas prices fell, and the performance of combustion turbines improved. These changes led to a reversal in the relationship between projected avoided costs and average electricity prices.

D. To Acquire a Least-Cost Resource

In the mid-1980s, there was growing recognition that improvements in customer energy efficiency could be had at costs lower than the marginal cost of production. In other words, it would be cheaper to save electricity than it would be to generate it. This insight was immortalized in the total resource cost (TRC) DSM benefit-cost test, which went on to become a foundation for integrated resource planning.

The relevance of this rationale today remains unchanged. Yet, while we have much better information on what energy savings really costs, the amount of savings that is cost-effective is likely to be much lower than was previously thought.

On the one hand, we now know that many utility DSM programs can save energy cost-effectively. Eto et al. examined data on 40 of the largest commercial sector DSM programs.[2] Their analysis showed a savings-weighted average cost of conserved electricity (CCE) of 3.2¢/kWh with a savings-weighted average TRC-test benefit/cost ratio of greater than three. On the other hand, not all utility DSM programs have been cost-effective; Eto et al. found that some of the smaller programs, which often focused on direct installation, cost more than they saved.

However, lower marginal costs mean that the threshold for cost effectiveness is now lower. Given the excess capacity that exists today in many regions, short-term avoided costs are often close to the operating costs of existing power plants (2.0 to 2.5¢/kWh). To be cost-effective, DSM programs today must deliver savings at less than 3¢/kWh. Ten years ago, that program needed only to be cheaper than 10¢/kWh. Nevertheless, DSM-potential studies suggest that large amounts of cost-effective energy savings remain untapped, even at these low avoided costs.

E. To Reduce Adverse Environmental Effects of Generation and Transmission

Electric utilities are major contributors to environmental problems, especially air pollution.

We have a better appreciation now for the uncertainties associated with the economic cost of environmental damages from emissions.

Emissions from power plants account for two-thirds of U.S. SO_2, one-third of NO_x, and one-third of CO_2 emissions. These emissions affect human health and mortality, visibility, commercial crops and fisheries, other flora and fauna, and man-made structures. In addition, exploration and extraction of fuels (e.g., coal mining and oil drilling), fuels transportation, and electricity transmission have environmental consequences, such as air and water pollution, land use issues, and solid-waste disposal.

As of the late 1970s, many of these environmental costs were not included in the price of electricity. Such unpriced effects are considered externalities, and were thought to account for a nontrivial percentage of the direct costs of electricity. To the extent that DSM programs reduced electricity production, these environmental costs would be reduced.

Two factors have changed since the '70s. First, recent federal and state laws either limit allowable emissions of various pollutants from power plants and transmission lines or incorporate environmental considerations explicitly in utility planning activities. Second, our understanding of the damages caused by these emissions has improved, leading, in some cases, to a better appreciation for the great uncertainties associated with estimates of the economic cost of these damages. Specifically, two recent studies, conducted by Hagler, Bailly Inc. and by Oak Ridge National Laboratory, suggest that the environmental damage caused by new, coal-fired power plants is on the order of 0.1¢/kWh, a factor of ten less than the values used by several state PUCs a few years earlier.[3]

Nevertheless, concerns regarding the threat of global warming from man-made carbon dioxide emissions have continued unabated. Whether the federal government will decide to act forcefully to reduce emissions of greenhouse gases is unclear. On one hand, we could decide to wait several years until the science of global warming provides additional answers with fewer uncertainties. On the other hand, we could decide that the potential damages from global warming are so great that we must act now. The effects of legislated or regulated efforts to reduce greenhouse gas emissions could have large effects on the costs of electricity production, in part because CO_2 is now completely unregulated. DSM could play a modest, but important, role in reducing U.S. CO_2 emissions.

F. To Compensate for Absence of Standards and Codes

To some, DSM programs initially represented a second-best solution to address the efficiency gap. They believed that standards and codes represented a more appropriate public policy, but embraced DSM because political opposition delayed the introduction of national appliance standards until the late 1980s. We take a broader view and believe that standards and codes can interact with utility DSM programs in a variety of ways. While they can, in some instances, replace the need for DSM programs, they can also (1) work synergistically with DSM programs to enhance the performance of both; and (2) provide a basis for DSM programs targeted to energy efficiency opportunities not appropriate for standards or codes.

Recent experience suggests that there are important synergies between standards and codes and utility DSM programs. For example, Geller and Nadel argue that certain utility programs are critical to the future evolution of standards and codes.[4] Working from a conceptual model of product introduction, commercialization, and ultimately codification through standards and codes, they believe that utility programs aimed at the early commercialization of advanced technologies, such as the super-efficient refrigerator program, are critical for updating future standards.

To some, DSM initially represented a second-best tactic to address the lack of standards and codes covering energy efficiency issues.

Nadel describes seven ways that utility DSM programs can work synergistically with building codes: (1) development of linkages between code requirements and eligibility levels for utility new-construction programs; (2) utility promotion of new code levels before they become mandatory; (3) utility promotion of efficient technologies and practices to lay the foundation for code updates; (4) utility advocacy for stronger code levels; (5) utility-sponsored training for code inspectors and building designers on code requirements and ways to meet code requirements; (6) utility financial assistance to state and local governments for energy-code enforcement efforts; and (7) utility hook-up requirements or fees based on code requirements.[5]

Whether DSM programs are substitutes for standards and codes depends on two questions. First, do standards and codes exist for the same end uses addressed by DSM programs? Second, to the extent they do not, what is the likelihood of future enactment of such standards and codes? The answer to this second question probably depends less on economics than on the political preference for "carrots" over "sticks." The answer also depends on the types of market barriers the policies are intended to overcome.

Pragmatism should temper the decisions framed as a choice between standards and DSM programs. Building code compliance and builder training can all be improved by either the government or by utilities. The political reality in most states, however, is that, given limited resources, code officials focus primarily on health and safety compliance, while energy efficiency codes are given less attention. In this situation, the issue is whether the extra costs of utility involvement to train code officials are acceptable. We believe that as long as the programs are cost-effective they should be pursued, because it is not realistic to assume that standards and codes will be met automatically, especially given the reality of limited enforcement.

Finally, several classes of energy efficiency opportunities are either not appropriate or not amenable for incorporation into standards or codes. These opportunities are potential candidates for utility DSM programs or other energy efficiency policies. For opportunities characterized by both low stock turnover and rapid technological progress (such as lighting equipment and space-conditioning systems), early retirement of existing equipment may be warranted. Similarly, better operation and maintenance practices represent a class of efficiency opportunities that do not involve equipment purchase. It is difficult to imagine how these opportunities could be captured by standards or codes. Hence, both may be good candidates for utility-run DSM programs.

II. Future Utility Roles in Delivering Energy Efficiency

Today's electric utility industry is undergoing rapid change. We conclude, however, that many of the early rationales for utility DSM programs remain relevant, although in different ways, today. In this section, we offer some thoughts on the direction of the industry's evolution and its implications for future utility energy efficiency programs.

Although the structure and regulation of *wholesale* competition will likely affect utility DSM programs, it is the prospect of widespread *retail* competition that will have the greatest impact on the future of such programs. Many utilities are already reducing DSM-program budgets based on the prospect—not the existence—of widespread retail access. It is, therefore, useful to discuss future utility roles in delivering energy efficiency around four key issues that retail competition raises for DSM programs:

(1) The utility's obligation to serve and the role that obligation implies for a utility in resource planning and acquisition on behalf of retail customers;

(2) The implications of the current transformation of DSM programs from an emphasis on resource value to customer value;

(3) The future structure of the electricity industry and the forms of regulation that are employed for the remaining monopoly functions; and

(4) The role of PUCs in adopting regulations that promote the public interest in energy efficiency.

A critical threshold question for the future of utility energy efficiency programs is the prospect for elimination of the retail-monopoly franchise.

A. The Obligation to Serve

Utility involvement in delivering energy efficiency as a least-cost resource alternative is based on the longstanding regulatory compact between a regulated utility and its PUC. In return for price regulation and an obligation to serve all customers on a nondiscriminatory basis, the utility is granted a monopoly franchise for the provision of least-cost electric service to all customers in a defined geographic area. Thus, the obligation to serve means that the utility assumes a resource portfolio management function (planning, acquisition, and operation) on behalf of its customers. This obligation is the primary rationale for requiring a utility to acquire energy efficiency whenever it costs less than supply options.

When retail wheeling relieves a utility from its obligation to serve certain customers, it also relieves the utility from its obligation to acquire resources for these customers using this least-cost planning principle. Thus, a critical threshold question for the future of utility energy efficiency programs is the prospect for elimination of the retail-monopoly franchise.

In the transition to full retail access by all customers, some "core" customers may choose to remain with their local utility and call on it for the traditional resource portfolio management functions. This distinction is already well-established for natural gas local distribution companies; most customers remain core customers (although they do not account for the majority of gas use).

Where the obligation to serve remains, the conditions under which pursuit of DSM as a least-cost resource option is appropriate are unaffected. However, the size of the energy efficiency resource available to the utility will likely be less than it is today because only part of the utility's former load will remain with core customers and because avoided costs will likely remain low for several years.

B. From Resource Value to Customer Value

The introduction of retail competition changes the definition of a utility. When there is no obligation to serve, utilities will become regulated distribution companies with an obligation only to *connect* all customers to the electric grid. In such a world, we expect to see two kinds of utility response, likely taking place in parallel. First, utilities will cut costs wherever possible because the marketability of their product (defined for the moment as kWh) will be determined by market conditions, not by their embedded costs.

Second, production efficiencies will be combined with strategies to differentiate and market distinct products and services. Energy efficiency will likely play an important part in many utilities' future product offerings. Newcomb describes a variety of innovative DSM roles that utilities could pursue in a more competitive environment.[6]

Thus, at the retail end of the business, the nature of a utility's DSM programs will change from their traditional emphasis on resource value to an emphasis on customer value. Utilities will have strong motivation to run such programs, the costs of which are borne primarily by program participants. Hence, we see little danger of DSM programs disappearing. However, because energy efficiency measures are not intrinsically separable into either resource-value or customer-value, the implications of these changes on the need for additional energy efficiency policies is not obvious.

When there is no obligation to serve, utilities will become regulated distribution companies with an obligation only to connect *all customers to the electric grid.*

Many believe, for example, that customer-value DSM programs will not emphasize energy efficiency to the extent that resource-value DSM programs have in the past. They point out that, at the present time, customer-value DSM programs tend to be offered to only the largest, most price-sensitive customers and that overall DSM budgets are much lower than in the past.[7]

C. Regulation of Remaining Monopoly Functions

The previous discussion deliberately blurred the distinction between the regulated and unregulated aspects of the utility's retail business activities. However, regulation will still exist in a world of retail competition. While regulated utilities with only an obligation to connect will no longer have generation-resource planning responsibilities, regulatory policies will continue to influence the utility's decisions on expansion of the local distribution system. In particular, we expect to see increased reliance on performance-based ratemaking approaches, which attempt to mimic the pricing and cost-minimizing discipline of unregulated markets, for remaining regulated business activities.[8]

If the form of regulation, performance-based or otherwise, does not discriminate against energy efficiency when it is the least-cost option, distribution utilities are likely to provide energy efficiency services that defer the addition of more expensive distribution system facilities. Thus, DSM will be targeted to specific geographic areas within the service territory. The load-shape objectives of these programs, moreover, will be local-area coincident-peak reductions. Thus, DSM programs will be narrower in geographic scope and will focus more on demand reductions (and less on energy savings) than do today's programs.

D. Future PUC Decisions

The critical outstanding issue for public policy is that with no entity retaining an obligation to serve, society will, by default, rely increasingly on the market to perform the formerly integrated generation, transmission, distribution, and demand-side planning functions. The unregulated retail businesses will provide energy-efficiency services through customer-value DSM programs, and regulated distribution utilities will provide DSM services based on the economics of local distribution systems, given the form of PUC regulation chosen. However, we believe it is inappropriate to assume that long-standing failures in energy-service markets will disappear overnight. Instead, we believe there remains broad public interest in government policies promoting energy efficiency.

Future PUC decisions will help determine whether and which entities deliver energy efficiency services to customers. Four regulatory policy issues figure centrally in this process:

(1) Will regulated utilities (in the limit, distribution entities) have planning and operating incentives embedded in rate-setting formulas or processes that are consistent with the public interest in energy efficiency?

(2) What criteria will PUCs use to review utility-proposed use of ratepayers funds for DSM programs if the primary purpose of these programs is customer value rather than resource value? Which programs should be funded by utility shareholders rather than by ratepayers?

(3) Will regulatory efforts to check market-power abuses by utilities or their subsidiaries operating in energy service markets help these markets mature and become fully competitive?

(4) To the extent that markets, rather than vertically integrated utilities, make end-use and supply-resource choices, how, if at all, will PUCs assess the consistency of these choices with the public interest? How will inconsistencies in these choices be addressed?

III. Summary

In conclusion, reports predicting the end of DSM are premature. However, it is naive to articulate any future for DSM without clear reference to the assumptions about industry structure, regulation, and future public policies. Regulation of the utility industry is changing, not disappearing. Utility interest in energy efficiency is also changing, but not likely to disappear. To the extent there remain socially beneficial energy efficiency opportunities that regulated utilities are uniquely poised to capture, there remains adequate justification for public policies to ensure that they are not left behind. ■

Endnotes:

1. This article is adapted from E. Hirst and J. Eto, Justification for Electric-Utility Energy-Efficiency Programs, ORNL/CON-419, Oak Ridge Nat'l Lab., Oak Ridge, Tenn. (August 1995).

2. J. Eto, S. Kito, L. Shown, and R. Sonnenblick, Where Did the Money Go? The Cost and Performance of the Largest Commercial Sector DSM Programs, Lawrence Berkeley Nat'l Lab. report LBL-38021 (1995).

3. R. Lee, The U.S.-EC Fuel Cycle Externalities Study: The U.S. Research Team's Methodology, Results and Conclusions; and R. D. Rowe et al., The New York Environmental Externalities Cost Study: Summary of Approach and Results, EC, IEA, and OECD Workshop on the External Costs of Energy, Brussels, Belgium (Jan. 1995).

4. H. Geller and S. Nadel, *Market Transformation Strategies to Promote End-Use Efficiency*, ANN. REV. OF ENERGY AND THE ENVIRONMENT 19, 301-346 (Annual Reviews, Inc., Palo Alto, Calif.)(1994).

5. S. Nadel, *Improving Coordination Between State Energy Codes and Utility New Construction Programs*, Proceedings from Building for the Future, New Construction Programs for Demand-side Management Conference, South Lake Tahoe, Calif. (May 1992).

6. J. Newcomb, *Energy Efficiency Services: What Role in a Competitive Environment?* ELEC. J., Nov. 1994, at 34-45.

7. Utility reports to the Energy Information Administration show a projected decline in utility DSM expenditures, from $2.7 billion in 1994 to $2.5 billion in 1999. On the other hand, utilities expect to increase the energy savings caused by their programs, from 52 billion kWh in 1994 to 72 billion kWh in 1999. See Energy Information Administration, ELECTRIC POWER ANNUAL 1994, DOE/EIA-0348(94)/2, U.S. Department of Energy, Washington, D.C. (Nov.1995).

8. G.A. Comnes, S. Stoft, N. Greene and L. Hill, *Six Useful Observations for Designers of PBR Plans*, ELEC. J., April 1996, at 16.